

Sports-Related Injuries in Youth Athletes: Is Overscheduling a Risk Factor?

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Objective: To examine the association between “overscheduling” and sports-related overuse and acute injuries in young athletes and to identify other potential contributing factors to create a working definition for “overscheduling injury.”

Design: Survey.

Setting: Six university-based sports medicine clinics in North America.

Participants: Athletes aged 6 to 18 years (13.8 ± 2.6) and their parents and pediatric sports medicine-trained physicians.

Interventions: Questionnaires developed from literature review and expert consensus to investigate overscheduling and sports-related injuries were completed over a 3-month period.

Main Outcome Measures: Physician's clinical diagnosis and injury categorization: acute not fatigue related (AI), overuse not fatigue related (OI), acute fatigue related (AFI), or overuse fatigue related (OFI).

Results: Overall, 360 questionnaires were completed (84% response rate). Overuse not fatigue-related injuries were encountered most often (44.7%), compared with AI (41.9%) and OFI (9.7%). Number of practices within 48 hours before injury was higher (1.7 ± 1.5) for athletes with OI versus those with AI (1.3 ± 1.4 ; $P = 0.025$). Athlete or parent perception of excessive play/training without adequate rest in the days before the injury was related to overuse ($P = 0.016$) and fatigue-related injuries ($P = 0.010$). Fatigue-related injuries were related to sleeping ≤ 6 hours the night before the injury ($P = 0.028$).

Conclusions: When scheduling youth sporting events, potential activity volume and intensity over any 48-hour period, recovery time between all training and competition bouts, and potential between-day sleep time (≥ 7 hours) should be considered to optimize safety. An overscheduling injury can be defined as an injury related to excessive planned physical activity without adequate time for rest and recovery, including between training sessions/competitions and consecutive days.

Key Words: overscheduling, sports, overuse injuries, musculoskeletal complaints, athletes

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INTRODUCTION

Thirty to 45 million children and adolescents between 6 and 18 years are involved in organized sport, with 70% of male students and 53% of female students participating on 1 or more sports teams.¹ Not surprisingly, sports-related injury is the leading cause of injury among school-aged children.² Acute injuries can result from a single accident, such as a fall or direct trauma; however, overuse injuries are a rising concern in this population.^{3,4} Overuse injuries occur as a result of repetitive microtrauma from chronic submaximal loading of tendons, muscles, or bones beyond the level required for fitness and conditioning gains, without adequate rest for positive adaptation. Clinically, these patients present with problems after several weeks of symptomatic activities, often with a history of increasing exercise and/or repetitive movements. Viable contributing factors are (1) excessive exercise intensity, training, and competition, (2) seasons that are too long, (3) inappropriate skill, and (4) competition demands at young ages. Notably, the incidence of reported overuse injuries among young athletes is highest in basketball, football, baseball, soccer, tennis, gymnastics, and long-distance running and increases with level of competition.^{5,6}

Volume and frequency of exercise as determined by the scheduling of practices, games, and matches are important extrinsic risk factors related to injury risk.^{4,7} Accordingly, there is growing clinical concern regarding overscheduling in youth sports, contributing to overuse injuries.^{4,7} While free play is generally self-regulating, based on physical tolerance and level of enjoyment, adult-organized sports can impose unreasonable training and competition schedules on youth athletes. Routinely, children and adolescents are expected to train and compete in long practice sessions and tournament

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events without adequate rest, hydration, and nutrition between bouts,⁸ which can occur across multiple days. Other potential contributing factors for pediatric overuse injuries include undeveloped physical and cognitive skills, vulnerability of the immature musculoskeletal system, nutritional deficits, and insufficient level of physical fitness. Excessive fatigue may also play an underlying role in the development of overuse and acute injuries.^{4,7}

A major challenge in identifying relevant variables for overscheduling is defining criteria that would apply to different sports. Accordingly, our study included questions on the circumstances and potential contributing factors related to scheduling of each injury. Overscheduling was hypothesized to be a greater contributing factor in the development of overuse injuries, more so than with acute sports-related injuries. Creating a working definition of an “overscheduling injury” should provide a greater appreciation of risk factors for these particular sports-related injuries in young athletes that will assist practitioners to recognize and address this growing problem. Moreover, identifying modifiable factors related to overscheduling injury risk should provide direction for developing more appropriate, evidence-based, and safe scheduling recommendations for youth sports governing bodies and event administrators.

METHODS

Population

The study population included a sample of patients visiting 1 of 6 university-based sports medicine clinics in the United States and Canada for evaluation of a new sports-related or other physical activity-related injury. Patients between 6 and 18 years old were offered the survey. Signed informed parental consent and assent for children were obtained. Patients who presented with an injury unrelated to sports or physical activity were excluded.

Survey Tool

Factors associated with “overscheduling” in youth sports were based on the literature review and expert consensus. The questionnaire was developed with input from sports medicine experts participating in an American College of Sports Medicine Roundtable on Youth Sports Scheduling in 2008. Keywords searched in the PubMed database (www.pubmed.gov) included *pediatric*, *overuse injuries*, *overtraining*, *scheduling*, and *sports injuries*. The institutional review board at each participating institution approved the study.

Survey Protocol

On arrival to the clinic, the parent and athlete were asked to complete the survey before meeting the physician (Figure 1). After the clinic visit, the subject's questionnaire was included or excluded, based on the physician's interpretation of whether the injury was related to sports or other physical activity. The physician then completed his/her portion of the survey (Figure 2), indicating the diagnosis and categorizing the injury into 1 of the 4 categories: acute not fatigue-related injury (AI), overuse not fatigue-related injury (OI), acute fatigue-related injury (AFI), and overuse fatigue-related injury

(OFI). Responses were based on the clinician's interpretation of the history, physical examination, and any other clinical evaluations available on the initial visit only. All participating physicians in this study had pediatric sports medicine fellowship training.

Data Analysis

The data were analyzed using SPSS 15.0 (SPSS, Inc, Chicago, Illinois). Descriptive frequencies were performed on survey items. Categorical variables with small cell counts were recategorized into dichotomous variables. Physician categorization of injuries was analyzed using χ^2 test. Fisher exact test was used if cell counts were small (less than 5). *T* tests were performed to compare numbers of hours, games, and practices between overuse and acute injuries overall and between fatigue-related and not fatigue-related injuries. Outlier responses were carefully reviewed and removed when appropriate. Statistical significance was set at $P \leq 0.05$.

RESULTS

The study population was 13.8 ± 2.6 years old. There were 360 injuries recorded from the 6 study centers over a 3-month collection period (Table 1). The response rate was 84% (range among centers = 67%-95%), with 360 of 430 patients asked completing the survey.

Types of Injuries and Location

Combining fatigue-related and not fatigue-related injuries, overuse injuries were more prevalent than acute injuries (54.4% vs 45.6%). For acute and overuse injuries, fatigue was an apparent contributing factor in 48 patients (13.3% of sample).

Two hundred seventy-seven surveys indicated clear physician diagnoses localized to a specific body area. Most common injuries involved the knee (85), followed by foot (29), spine (29), lower leg (26), shoulder (25), hip (19), and ankle (16). Tissue injuries comprised 274 diagnoses: ligament injuries/sprains (45), tendinopathy (including strains and tendinitis) (40), apophysitis (25), cartilage problems (osteochondral or meniscus problems) (13), patellofemoral problems (subluxation or patellofemoral pain) (26), fractures (25), bone overuse injuries including stress fractures (24), soft tissue injuries (25), muscle strains (17), and spine-related problems (23). The injury sample included 33 concussions (9.2% of reported injuries), with 19 reported from the Boston clinic, likely due to their specialized concussion clinic. Excluding the Boston data, concussions comprised 4.0% of the survey population.

Most commonly, athletes reported participating in basketball, football, soccer, or running when injured (Table 2). Contact sports, such as football and basketball, reported higher acute injuries, and running, basketball, and gymnastics indicated the most overuse injuries. Soccer, running, and baseball had the most OFI.

Physician Responses/Risk Factors

Physician survey data contained no missing responses. Significant contributing factors for overuse injuries (Table 3) included the following: training error, overuse mechanism/pathology, fatigue as a factor in the injury, and genetic predisposition (morphological or other underlying conditions,

eg, Ehler-Danlos syndrome, congenital bunions, etc). Acute injuries were primarily contact injuries.

Significant factors linked with fatigue-related injuries included training error ($P < 0.001$), incomplete rehabilitation of a previous injury ($P < 0.001$), overuse mechanism/pathology ($P = 0.001$), fatigue as a factor in the injury ($P < 0.001$), and genetic predisposition ($P = 0.023$). Contact injury was related to not fatigue-related injury ($P = 0.002$).

Athlete/Parent Responses/Risk Factors

The average amount of physical activity on the day preceding the injury was 2.0 ± 2.1 hours (Table 4; all injuries combined), and during the 72 hours before the injury was 5.2 ± 4.1 hours (median value, 4.5 hours). Missing responses for these questions were 69 and 65 surveys, respectively. The average number of practices within 48 hours before the injury was 1.7 ± 1.5 for subjects with overuse injuries compared with 1.3 ± 1.4

Injury risk factor survey completed by athlete/parent

Date:

Age:


In the table below, please list the sports and activities that you (your child) participate in throughout the year. If you (your child) participate in more than one sport or activity, answer the questions for each on (for example, soccer and tennis; dance and basketball; gymnastics, swimming, and softball).

Name of Sport / Activity	Hours/week this season (Total practice, games, tournaments)	Seasons of year that you (your child) play

Answer the questions below for the injury that you are being seen for today.

What activity/sport caused today's injury?	Sport/Activity:
How much physical activity had you (your child) done on the day that you were injured? (total of all warm-up, practice, conditioning, or other physical training, in this and all other sports that day)	# Hours:
How much physical activity had you (your child) done in the 72 hours (3 days) before the injury?	# Hours:
How many games/competitions had you (your child) played within the preceding 48 hours (2 days) before the injury?	# Games/Competitions:
How many practices did you (your child) have within the preceding 48 hours (2 days) before the injury?	# Practices:
If you (your child) had more than one game or practice in a day, did you (your child) have time between to eat meals and drink water?	Y N
If you (your child) had more than one game or practice in a day, did you have time between to eat meals / food?	Y N

FIGURE 1. Athlete/parent questionnaire.

On the day when you (your child) were injured, were you (your child) training or playing before 7 a.m. or after 10 p.m.?	Y N
Did you (your child) have less than your (your child's) usual amount of sleep hours the night before your injury because of sports activities?	Y N
How many hours do (your child) usually sleep (check one)?	6 or less <input type="checkbox"/> 7 <input type="checkbox"/> 8 <input type="checkbox"/> 9 <input type="checkbox"/> 10 or more <input type="checkbox"/>
Did you have several consecutive days of decreased sleep because of sports activities when you got injured?	Y N
Do you (your child) feel that too much play / training over the last few days with not enough time to rest up during this time before you (your child) got injured? (circle one)	Y N
Did you (your child) have more than one game / session on the day you got injured?	Y N
If yes, did you (your child) have enough time to rest up since your (your child) last game / session?	Y N
Some people get to play more than others. How much of the game/activity do you (your child) usually play? (circle one)	Percent of game: 0 20 40 60 80 100
Are you currently playing on more than one team or participating with one group at the same time? (circle one)	Y N
If yes, how many?	# Teams/Groups:
Do you (your child) play more than one sport at this time of year / season? (circle one)	Y N
If yes, how many?	# Sports/Activities:
Does your (your child) parent(s) attend your practices /games/ competitions? (circle one)	Always Sometimes Never
Do you (your child) feel you (your child) would get better from this injury?	Y N
Choose the face that best describes how you (your child) are feeling?	
 <p>0 NO HURT 1 HURTS LITTLE BIT 2 HURTS LITTLE MORE 3 HURTS EVEN MORE 4 HURTS WHOLE LOT 5 HURTS WORST</p>	

Thank you (your child) for completing your part of the survey!

FIGURE 1. Continued.

for those with acute injuries ($P = 0.025$). The median values indicated 2 practices for overuse injuries and 1 practice for acute injuries, within the 2 days before the injury occurrence. The average number of practices within 48 hours before the injury was 1.9 ± 1.6 for fatigue-related injuries and 1.4 ± 1.4 for injuries not related to fatigue, although the difference was not statistically significant ($P = 0.071$). Playing on more than 1 team

or more than 1 sport at the time of injury was not significantly related to any injury category. Regarding outliers, 4 cases of athletes indicated 8 to 20 hours of activity on the day of the injury and were removed. Generally, the removal of outlier data did not affect the outcome measures that were significant, except in the 5 cases where athletes indicated 5 to 10 games or 10 practices or more within 48 hours.

For doctor’s use only:

Diagnosis: _____

In your opinion, was this injury related to (please circle/check any that apply):

Y	N	Training error (excessively rapid increase in training time/intensity, coaching change, etc)?
Y	N	Equipment problem?
Y	N	Incompletely rehabilitated previous injury?
Y	N	Overuse injury mechanism / pathology?
Y	N	Fatigue (perceived by the patient) as a factor in the injury?
Y	N	Contact injury (instead of non-contact)
Y	N	Genetic predisposition (anatomic alignment, inherent flexibility or other)
		In your opinion, this injury is best described as: Acute trauma <input type="checkbox"/> Acute trauma – fatigue related <input type="checkbox"/> Overuse injury <input type="checkbox"/> Overuse injury – fatigue related <input type="checkbox"/>

FIGURE 2. Physician questionnaire.

Athlete or parent perception of too much play or training over the immediate few days before the injury without enough time to rest between bouts was positively related to overuse injuries ($P = 0.016$) and fatigue-related injuries ($P = 0.010$). There was a statistically nonsignificant trend of more fatigue-related injuries when more than 1 game was played on the day of injury ($P = 0.15$) and when parents/athletes perceived that rest was inadequate between bouts of exercise ($P = 0.11$). Sleeping 6 or fewer hours the night before the injury was associated with all the fatigue-related injuries ($P = 0.028$). However, no statistically significant association was identified between fatigue-related or overuse-related injuries and getting less sleep than usual or several days of decreased sleep.

TABLE 1. Injury Category Distribution and Totals (Percent of Sample) by Evaluation Center

Evaluation Center	Injuries Reported	Acute Not Fatigue-Related	Acute Fatigue-Related	Overuse Not Fatigue-Related	Overuse Fatigue-Related Injury
Boston	74	38	1	34	1
Chicago	50	12	2	21	15
Norfolk	75	29	0	45	1
Philadelphia	72	39	4	24	5
San Francisco	52	25	5	14	8
Toronto	37	8	1	23	5
Total	360	151 (41.9%)	13 (3.6%)	161 (44.7%)	35 (9.7%)

DISCUSSION

Among physicians, the relationship between “overuse” and injuries in youth sports is recognized and appreciated.⁴ This study is an initial step in examining overscheduling as a potential contributing factor. The term “overuse” injury is loosely used in medicine to encompass any injury related to excessive exercise; but there is little understanding of the amount of activity or loading frequency needed to develop such an injury. Without a clear criterion for “overuse” injury, we relied on the clinical experience of our pediatric sports medicine–trained physicians to diagnose and classify “overuse” injuries.

In studying new issues in youth sports, new terminology may be needed to describe the problems and with new tools to identify the risk factors. This study suggests that a positive association exists between overscheduling and injuries determined by a physician to be overuse related. Moreover, the high prevalence of overuse injuries (54.4%) observed here among the surveyed university-based sports medicine clinics underscores the validity of concern over this growing problem in youth sports.^{4,7} Notably, overuse injuries are likely seen more frequently in these outpatient settings because many acute traumatic injuries initially present to the emergency room or urgent care and are later followed in sports clinics.⁹

Number of Practices/Games

Consistent with our hypothesis, respondents with overuse injuries reported more practices within 2 days of the injury as compared with those with acute injuries. However, fatigue-related

TABLE 2. Distribution of Sports (Number of Injuries) in Each Injury Category (N = 360)

Acute Not Fatigue-Related	Acute Fatigue-Related	Overuse Not Fatigue-Related	Overuse Fatigue-Related Injury
Football (29)	Basketball (3)	Running (23)	Baseball (5)
Basketball (20)	Football (2)	Basketball (20)	Running (5)
Hockey (14)	Soccer (2)	Gymnastics (16)	Soccer (5)
Soccer (11)	Other (3)	Soccer (13)	Basketball (2)
Wrestling (9)	No response (3)	Baseball/Softball (10)	Wrestling (2)
Other (55)	—	Other (52)	Other (12)
No response (13)	—	No response (27)	No response (4)

injuries were not significantly associated with the number of immediate preinjury practices (within 48 hours), although there was a strong trend ($P = 0.071$). Some literature suggests a higher number of injuries during competitions compared with practices, possibly due to higher intensity or level of play.^{10,11} But the present study does not support that the number of games within 48 hours or the number of hours of physical activity in the 72 hours before injury are significant contributing factors to fatigue-related or overuse injuries. The survey size and variety of sports included in the analyses, with varying schedules and different formats for games or matches, may explain the absence for any associations between these expected contributing factors to injury risk. Accordingly, assessment of overscheduling should probably be sport specific. However, coaches and parents should still consider the potential associated injury risk when determining the “need” for multiple-practice days, when their young athletes are participating in tournament events.

Perceived Excessive Play/Training Before Injury

A significant associated factor to both a diagnosed overuse injury and a fatigue-related injury was the parent/athlete

TABLE 3. Physician Survey Responses/Risk Factors Comparing Acute Versus Overuse Injury Categories (χ^2 Analyses)

		Counts		P
		Acute Injuries	Overuse Injuries	
Training error	Yes	12	100	<0.001
	No	152	96	
Equipment problem	Yes	8	20	.075
	No	156	176	
Incompletely rehabilitated previous injury	Yes	32	52	0.13
	No	132	144	
Overuse injury	Yes	3	177	<0.001
	No	161	19	
Fatigue	Yes	13	40	0.001
	No	151	156	
Contact injury	Yes	99	13	<0.001
	No	65	183	
Genetic predisposition	Yes	20	106	<0.001
	No	144	90	

response to the question “Do you (your child) feel that there was too much play/training over the last few days, with not enough time to rest up during this time before you (your child) got injured?” The potential bias of this question must be acknowledged; however, neither the consent form nor the survey indicated overuse or overscheduling as the topic of our concern. Although the number of teams and sports the athlete concomitantly participated in was not found to be a significant contributing factor to injury, multiple team/sport involvement should also be recognized as an area of concern. Although such participation and overscheduling may be prompted by and acceptable to a parent and child, the training and competition loads are often excessive. Accordingly, the American Academy of Pediatrics recommends that athletes should not participate in more than 1 team or sport in any 1 season.⁴

Amount of Sleep

Another notable parent/athlete response positively associated with fatigue-related injuries was sleeping only 6 or fewer hours. Research indicates a relationship between sleep deprivation and decreased performance in adults,^{12,13} which may be similar in the pediatric population. There was no difference found in the hours of sleep on average or reported sleep deprivation between the overuse and acute injury groups. However, with evidence of the apparent contributing role of fatigue in injury risk, planning for adequate sleep before and during training or competition events should be another important consideration in determining a young athlete’s training schedule and setting up an event schedule, especially if travel is involved.

Sport-Specific Injury Findings

Injuries within each category were fairly evenly distributed among the “primary” sports included here, with an overall greater observed incidence of overuse and acute trauma injuries that were not fatigue related (Table 2). Basketball injuries were notably high in acute trauma and overuse injury categories, which underscores the high dynamic physical stresses and potential for contact-related injuries of basketball. It was not surprising that American football, being a high-contact sport, presented a high number of acute injuries that were not related to fatigue. Notably, our soccer athletes also exhibited a comparatively higher number of not fatigue-related injuries, although poor performance during youth soccer tournaments is reportedly related to physical fatigue and other factors, such as overcoaching, player boredom, player anxiety, and problem sleeping.¹⁴ Our results did not reflect the high incidence of fatigue-related elbow and shoulder complaints reported in baseball in previous studies,^{15,16} perhaps due to current better implementation of pitch counts as a preventative measure. Although not a focus of this study, we found that incomplete rehabilitation of a previous injury was reported in 20% of acute and 27% of overuse injuries. This highlights the critical importance of full rehabilitation of sport-related injuries in youth before returning to play.

Recommendations

The amount of time needed for children and adolescents to sufficiently recover between bouts of sport-related physical activity (training sessions or competitions) is likely multifactorial,

TABLE 4. Parent/Athlete Survey Responses/Risk Factors Comparing Acute Versus Overuse Injury Categories (χ^2 Analyses)

Survey Item	No. Missing Entries		Counts		P
			Acute Injuries	Overuse Injuries	
Adequate meals and drink in between sessions	67	Yes	119	145	0.12
		No	18	11	
Playing before 7 AM or after 10 PM	24	Yes	18	16	0.48
		No	140	162	
Getting less than usual amount of sleep	36	Yes	19	23	0.87
		No	133	149	
Getting 6 or fewer hours of sleep the night before	20	Yes	14	19	0.71
		No	145	162	
Having several days of decreased sleep	14	Yes	26	26	0.65
		No	136	158	
Too much playing time without enough rest	19	Yes	11	28	0.016
		No	149	153	
Playing more than 1 game on day of injury	21	Yes	19	26	0.52
		No	142	152	
If yes to above Q, enough time to rest between games	4 (315)*	Yes	11	12	0.52
		No	6	12	
Playing on more than 1 team at the time of injury	9	Yes	47	57	0.82
		No	116	131	
Playing in more than 1 sport at the time of injury	7	Yes	49	64	0.57
		No	113	127	
Patient feels he/she would get better from injury	90	Yes	103	138	1.0
		No	12	17	
No. hours of activity on the day of injury	69	\bar{x}	2.0 (2.5)	2.0 (1.6)	0.99
		\tilde{x}	1.5	2	
No. hours of activity within 72 hours before injury	65	\bar{x}	5.4 (4.6)	5.0 (3.5)	0.31
		\tilde{x}	5	4	
No. games within 48 hours before injury	58	\bar{x}	0.78 (1.5)	0.70 (1.2)	0.59
		\tilde{x}	0	0	
No. practices within 48 hours before injury	53	\bar{x}	1.3 (1.4)	1.7 (1.5)	0.025
		\tilde{x}	1	2	

SDs are listed in parentheses next to mean values.

*Three hundred fifteen people answered “no” to the previous question and therefore did not answer this question. Of the people who responded “yes” to the previous question, 4 people did not answer this question.

\bar{x} , mean; \tilde{x} , median.

considering physical activity intensity and duration, environmental conditions, nutritional challenges (eg, carbohydrate, water, and electrolyte recovery), and psychosocial factors.^{7,17,18} Importantly, the schedule should be altered to reasonably optimize safety. For example, to minimize acute overload and undue fatigue, an appropriate schedule that allows for adequate recovery between games or practices should be strongly considered. However, there are competing issues in youth sports, including increasing competition, playing time opportunities for youth athletes, and maximizing use of sports facilities. These challenges must be addressed in reducing overscheduling-associated injury risk.

Until there are more definitive studies regarding fatigue, recovery time, and injury risk in youth sports, we recommend at least 2 hours of recovery between moderate-intensity and vigorous-intensity sport-related training sessions and competitions that last more than 1 hour, to allow sufficient rest and nutrient recovery. Especially in hot environments, the amount of daily activity should be carefully considered and monitored,

and young athletes should be allotted even *more* time to recover between consecutive games or practices. Particular care should be taken to avoid excessive cumulative fatigue or nutritional and fluid deficits, if there are several rounds of competition on consecutive days. Notably, high-intensity sports with competition bouts of much shorter duration (eg, wrestling) may also require longer between-bout recovery periods to minimize cumulative fatigue and related injury risk and performance deficits.

When planning schedules, event organizers and administrators and coaches should consider the number of practices and competitions in any 48-hour period and impose reasonable limitations based on age and planned/expected intensity and duration of each bout. The schedule should include fewer sessions with younger kids, as well as when intensity and duration increase. The schedule should also allow for adequate sleep for all athletes. Accordingly, teams or individuals who play late should not be scheduled for early competition or

practice the next day. Youth athletes should be expected to have at least 7 or more hours of sleep each day. Moreover, travel time to and from distant events and providing sufficient time to eat and rest should be considered by parents and coaches when scheduling their athletes' participation. Evidence here indicates that planning appropriate time to rest between sports-related physical exertion bouts is critical. Parents and athletes also perceive this to be a significant concern.

We propose that an overscheduling injury be defined as an injury related to excessive planned physical activity without adequate time for rest and recovery. In this context, our findings support our hypothesis that overscheduling is a greater contributing factor in the development of overuse injuries, more so than with acute sports-related injuries.

Limitations

Definitions, such as overuse injuries, and recommendations largely rely on the expert opinion. Start dates varied slightly with each center, and those beginning the data collection in the late fall may have had fewer patient visits due to holidays and the school sports schedules. Overscheduling injuries may be more likely to occur when both school and travel sports are concurrently in season, for those youth athletes participating in both. The fact that much of our data were collected in part when there was not a high degree of such overlap suggests that the prevalence of injuries related to overscheduling may be even greater during specific times of the year than observed here. One center inadvertently used an old version of the study questionnaire. However, the responses were recategorized or added as necessary using the reported data to match the final survey. Missing data were also identified mainly regarding food and drink consumption and the number of hours of practice and games, which most likely was more difficult for the parent/athlete to recall accurately.

CONCLUSIONS

An overscheduling injury can be defined as an injury related to excessive planned physical activity without adequate time for rest and recovery. When scheduling youth sporting events, potential activity volume and intensity over any 48-hour period should be considered and potential between-day

sleep time should be at least 7 hours, preferably more. Recovery time between training and competition bouts should be regularly evaluated and carefully considered by coaches, parents, and organizers to optimize safety and then efficiency of scheduling.

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